Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/EP05/001434

International filing date: 12 February 2005 (12.02.2005)

Document type: Certified copy of priority document

Document details: Country/Office: EP
Number: 04003391.2
Filing date: 16 February 2004 (16.02.2004)

Date of receipt at the International Bureau: 15 March 2005 (15.03.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

Europäisches Patentamt	European Patent Office	Office européen des brevets

Bescheinigung | Certificate | Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.	The attached documents are exact copies of the European patent application described on the following page, as originally filed.	Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr.	Patent application No.	Demande de brevet n°
	04003391.2	

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

R C van Dijk

Anmeldung Nr:
Application no.: 04003391.2
Demande no:

Anmeldetag:
Date of filing: 16.02.04
Date de dépôt:

Anmelder/Applicant(s)/Demandeur(s):

BASF AKTIENGESELLSCHAFT

67056 Ludwigshafen
ALLEMAGNE

Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
Si aucun titre n'est indiqué se referer à la description.)

Formulation for seed treatment

In Anspruch genommene Priorität(en) / Priority(ies) claimed /Priorité(s) revendiquée(s)
Staat/Tag/Aktenzeichen/State/Date/File no./Pays/Date/Numéro de dépôt:

Internationale Patentklassifikation/International Patent Classification/
Classification internationale des brevets:

A01N/

Am Anmeldetag benannte Vertragstaaten/Contracting states designated at date of filing/Etats contractants désignées lors du dépôt:

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL
PT RO SE SI SK TR LI

Formulation for seed treatment

The present invention comprises a seed treatment formulation comprising

(a) at least one pesticidal agent; and

(b) a carboxyl group containing polymer or copolymer or wax, wherein the carboxyl groups are selected from the group consisting of -C(O)OH or -C(O)OR^1, R^{2}OC(O)~ wherein R^1 and R^2 each are C_1-C_{40}-alkyl;

Seed treatment is a promising method for the protection of seeds against pests (fungi and insects) suitable for crop seeds such as those selected from the group of corn (sweet and field), soybean, wheat, barley, oats, rice, cotton, sunflower, alfalfa, sorghum, rapeseed, sugarbeet, Brassica spp., tomato, bean, carrot, tobacco and flower seed, for example, pansy, impatiens, petunia and geranium as described by Japan Plant Protection Association (p. 133-139 "Pesticide Application Technology", 1998).

One of the problems the farmer is faced with is the fast release of the pesticidal agent used for seed treatment in the soil or in the water. Especially in rice seed treatment (e.g. in a seed soaking process), the release of the pesticidal agent is a huge problem because of environmental safety on the one hand and the loss of protection by the pesticidal agent against soil born fungi and insects on the other hand.

WO 01/78507 discloses a rice seed treatment formulation used in a non-soaking process, employing the polyvinylacetates, polyvinlyaclohols, polyvinylpyrrolidones and mixtures of polyurethanes as polymers for the seed treatment formulation.

WO 02/080675 discloses seed treatment formulations disclosing a wide range of polymers suitable for seed treatment formulation.

All of the afore-mentioned formulations show release of the pesticidal agent into the environment.

Thus, it is an object of the present invention to provide a formulation for seed treatment, which keeps the pesticidal agent on the seed and prevents significant release into the environment (the water or the soil), preferably during a seed soaking and/or priming process.

This object is achieved in the present invention by providing a seed treatment formulation comprising

(a) at least one pesticidal agent; and

(b) at least a carboxyl group containing polymer or copolymer or wax, wherein the carboxyl groups are selected from the group consisting of ~C(O)OH or ~C(O)OR^1, R^2(O)CO~ wherein R^1 and R^2 each are C_1-C_{40}-alkyl; or

In a preferred embodiment, the formulation comprises

(a) at least one pesticidal agent; and

(b) at least a carboxyl group containing polymer or copolymer, wherein the carboxyl groups are selected from the group consisting of ~C(O)OH or –C(O)OR^1, R^2(O)CO~ wherein R^1 and R^2 each are C_1-C_{40}-alkyl; or

The content of the carboxyl group in the carboxyl group containing polymer or copolymer is at least between 0.05% (w/w) and 20% (w/w), preferably between 0.05% (w/w) and 5% (w/w), more preferably between 0,1% (w/w) and 3% (w/w).

Besides the definition of the Deutsche Gesellschaft für Fettwissenschaft (DGF, German Association for Fat Science; DGF-Einheitsmethoden, Abteilung M: Wachse und Wachsprodukte. Stuttgart 1975; Erläuterungen des Rates für die Zusammenarbeit auf dem Gebiet des Zollwesens 3404/1 (1992) und 3404/2 (1988): International Customs Tariff, Harmonized System HS 3404: "Artificial Waxes (Including Water-Soluble Waxes); Prepared Waxes, not Emulsified or Containing Solvents" according to which a wax has to fulfil the following criteria

- a drop point (mp) >40°C
- the melt viscosity must not exceed 10 000 mPa · s at 10 °C above the drop point
- the wax should be polishable under slight pressure and have a strongly temperature-dependent consistency and solubility
- at 20 °C they must be kneadable or hard to brittle, coarse to finely crystalline,
- transparent to opaque, but not glassy, or highly viscous or liquid
- above 40 °C they should melt without decomposition
- above the mp the viscosity should exhibit a strongly negative temperature dependence and the liquid should not tend to stringiness
- waxes should normally melt between ca. 50 and 90 °C (in exceptional cases up to 200 °C)
- waxes generally burn with a sooting flame after ignition

the wax to be used in the above-mentioned formulation has to contain a carboxyl group wherein the carboxyl group is selected from the group consisting of –C(O)OH or ~C(O)OR^1, R^{2}O C(O)~ wherein R^1 and R^2 is C_1-C_{40} alkyl.

The carboxyl group containing wax according to the invention comprises natural and synthetic waxes.

Natural waxes mean fossil waxes such as petroleum waxes e.g. ozocerite, macrocrystalline paraffin waxes and microcrystalline paraffin waxes and lignite peat and montean waxes. The lignite peat and montean waxes can be chemically modified so that e.g. acid oxidized waxes, etherified acid waxes and partially neutralized acid waxes can be obtained.

Synthetic waxes are partially synthetic waxes, which can be divided into partially synthetic waxes such as fatty acid amide waxes and fully synthetic waxes such as polyolefin waxes (e.g. polyethylene waxes or polyethyle waxes), Fischer-Tropsch waxes, polar synthetic waxes (e.g. oxidates, copolymers)

A formulation, wherein at least one monomer of the carboxylgroup containing polymer or copolymer is selected from the group consisting of

(1) (alkyl)acrylic acid and (alky) acrylic acid ester derivates such as

(a) alkyl (meth)acrylates such as methyl (meth)acrylate, ethyl (meth)acrylate, n-propyl (meth)acrylate, *n*-butyl (meth)acrylate, *t*-butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, stearyl (meth)acrylate, lauryl (meth)acrylate, cyclohexyl (meth)acrylate, stearyl (meth)acrylate, dodecyl (meth)acrylate, 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate,

b) fluorinated alkyl (meth)acrylates such as fluoroalkyl (meth)acrylates; trifluoroethyl (meth)acrylate, pentafluoropropyl (meth)acrylate, heptafluorobutyl (meth)acrylate

c) siloxanyl compound such as" ; trimethylsiloxanyl dimethylsilyl propyl (meth)acrylate, tris(trimethylsiloxanyl)silylpropyl(meth)acrylate, di(meth)acryloylpropyl dimethylsilyl ether;

d) amino group containing (meth)acrylates such as dimethylaminomethyl(meth)acrylate, dimethylaminoethyl(meth)acrylate, dimethylaminopropyl(meth)acrylate, diethylaminomethyl(meth)acrylate, diethylaminopropyl(meth)acrylate

e) mono- or di-(meth)acrylates of alkylene glycol such as mono- or di-(meth)acrylates of ethylene glycol, 1,2-propanediol, 1,3-propanediol, 1,6-hexanediol,

f) alkoxyalkyl(meth)acrylates such as 2-methoxyethyl(meth)acrylate, 2-ethoxyethyl(meth)acrylate, 3-ethoxypropyl(meth)acrylate

g) aryloxyalkyl(meth)acrylates such as 2-phenoxyethyl(meth)acrylate, 2-phenoxypropyl(meth)acrylate, 3-phenoxypropyl(meth)acrylate,

h) oligo(meth)acrylates such as di(meth)acrylates, tri(meth)acrylates or tetra(meth)acrylates of polyhydric alcohols like glycerol, 1,2,4-butanetriol, pentaerythritol, trimethylolalkane (C1 – C3), tetramethlolalkane (C1 – C3);

i) hydroxyalkyl(meth)acrylates such as 2-hydroxyethyl(meth)acrylate, 2-hydroxypropyl(meth)acrylate, 3-hydroxypropyl(meth)acrylate

j) ring opening condensed (meth)acrylates of cyclic esters designated by the following formula (I)

$CH_2=CR^4\text{-}COO\text{-}(C_mH_{2m}COO)_t\text{-}R^5$ ··· (I)

wherein
R^4 is C_1-C_5 alkyl, R^5 is hydrogen or C_1-C_{10} alkyl or a phenyl group, m and t is whole number of 1 to 10;
such as
$CH_2=CH\text{-}COO\text{-}C_3H_6COO\text{-}H$, $CH_2=C(CH_3)\text{-}COO\text{-}C_3H_6COO\text{-}H$, $CH_2=CH\text{-}COO\text{-}C_4H_8COO\text{-}H$, $CH_2=C(CH_3)\text{-}COO\text{-}C_4H_8COO\text{-}H$, $CH_2=CH\text{-}COO\text{-}C_5H_{10}COO\text{-}H$, $CH_2=C(CH_3)\text{-}COO\text{-}C_5H_{10}COO\text{-}H$, $CH_2=CH\text{-}COO\text{-}C_3H_6COO\text{-}CH_3$, $CH_2=C(CH_3)\text{-}COO\text{-}C_3H_6COO\text{-}CH_3$, $CH_2=CH\text{-}COO\text{-}C_4H_8COO\text{-}CH_3$, $CH_2=C(CH_3)\text{-}COO\text{-}C_4H_8COO\text{-}CH_3$, $CH_2=CH\text{-}COO\text{-}C_5H_{10}COO\text{-}CH_3$, $CH_2=C(CH_3)\text{-}COO\text{-}C_5H_{10}COO\text{-}CH_3$, $CH_2=CH\text{-}COO\text{-}C_5H_{10}COO\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}C_5H_{10}COO\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}C_5H_{10}COO\text{-}C_4H_9$, $CH_2=C(CH_3)\text{-}COO\text{-}C_5H_{10}COO\text{-}C_4H_9$, $CH_2=CH\text{-}COO\text{-}C_5H_{10}COO\text{-}C_8H_{17}$, $CH_2=C(CH_3)\text{-}COO\text{-}C_5H_{10}COO\text{-}C_8H_{17}$, $CH_2=CH\text{-}COO\text{-}(C_3H_6COO)_2\text{-}H$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_3H_6COO)_2\text{-}H$, $CH_2=CH\text{-}COO\text{-}(C_4H_8COO)_2\text{-}H$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_4H_8COO)_2\text{-}H$, $CH_2=CH\text{-}COO\text{-}(C_5H_{10}COO)_2\text{-}H$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_5H_{10}COO)_2\text{-}H$, $CH_2=CH\text{-}COO\text{-}(C_3H_6COO)_2\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_3H_6COO)_2\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}(C_4H_8COO)_2\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_4H_8COO)_2\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}(C_5H_{10}COO)_2\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_5H_{10}COO)_2\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}(C_5H_{10}COO)_3\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_5H_{10}COO)_3\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}(C_5H_{10}COO)_4\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_5H_{10}COO)_4\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}(C_5H_{10}COO)_5\text{-}C_2H_5$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_5H_{10}COO)_5\text{-}C_2H_5$, $CH_2=CH\text{-}COO\text{-}(C_5H_{10}COO)_2\text{-}C_8H_{17}$, $CH_2=C(CH_3)\text{-}COO\text{-}(C_5H_{10}COO)_2\text{-}C_8H_{17}$;

(2) (Meth)acrylamides such as dimethyl(meth)acrylamide, diethyl(meth)acrylamide, isopropyl(meth)acrylamide,(meth)acryloyl morpholine, dimethylaminomethyl(meth)acrylamide, dimethylaminoethyl(meth)acrylamide, dimethylaminopropyl(meth)acrylamide, diethylaminomethyl(meth)acrylamide, diethylaminoethyl(meth)acrylamide, diethylaminopropyl(meth)acrylamide and derivatives of (meth)acrylamides such as N-methyl acrylamide, N-methylol acrylamide, N-methylol methacrylamide;

(3) cyano(alky)acrylates such as cyanoalkyl(meth)acrylates; cyanoethyl(meth)acrylate, cyanopropyl(meth)acrylate;

(4) acrylonitriles such as acrylonitrile, methacrylonitrile;

(5) Unsaturated monocarboxylates such as methyl crotonate, ethyl crotonate, methyl cinnamate, ethyl cinnamate;

(6) Hydroxy alkyl esters of unsaturated carboxylic acids such as 2-hydroxyethyl crotonate, 2-hydroxypropyl crotonate, 2-hydroxypropyl cinnamate, glycidyl (meth)acrylate;

(7) Unsaturated (mono) carboxylic acids such as crotonic acid, cinnamic acids, maleic acid, itaconic acid;

(8) Unsaturated polycarboxylic acids and their anhydrides, mono- or di-esters such as maleic acid, fumaric acid, itaconic acid, citraconic acid, and the anhydrides of the aforementioned acids;

(9) Vinyl esters such as vinyl acetate, vinyl chloroacetate, vinyl propionate.

The monomers set forth above are hereinbelow referred to as "Monomer 1". The polymers comprising Monomer 1 can be homopolymers or copolymers consisting of at least two Monomers 1. The distribution of monomers in the respective coplymer is either is either alternate, statistical or block by block.

In a further embodiment of the invention, the copolymers can besides at least one Monomer 1 comprise at least one other monomer (herein below referred to as "Monomer 2") selected from the group consisting of

(1) C_2-C_6-alkenyl, such as ethenyl, 1-propenyl, 2-propenyl, 1-methylethenyl, 1-butenyl, 2-butenyl, 3-butenyl, 1-methyl-1-propenyl, 2-methyl-1-propenyl, 1-methyl-2-propenyl, 2-methyl-2-propenyl, 1-pentenyl, 2-pentenyl, 3-pentenyl, 4-pentenyl,

1-methyl-1-butenyl, 2-methyl-1-butenyl, 3-methyl-1-butenyl, 1-methyl-2-butenyl, 2-methyl-2-butenyl, 3-methyl-2-butenyl, 1-methyl-3-butenyl, 2-methyl-3-butenyl, 3-methyl-3-butenyl, 1,1-dimethyl-2-propenyl, 1,2-dimethyl-1-propenyl, 1,2-dimethyl-2-propenyl, 1-ethyl-1-propenyl, 1-ethyl-2-propenyl, 1-hexenyl, 2-hexenyl, 3-hexenyl, 4-hexenyl, 5-hexenyl, 1-methyl-1-pentenyl, 2-methyl-1-pentenyl, 3-methyl-1-pentenyl, 4-methyl-1-pentenyl, 1-methyl-2-pentenyl, 2-methyl-2-pentenyl, 3-methyl-2-pentenyl, 4-methyl-2-pentenyl, 1-methyl-3-pentenyl, 2-methyl-3-pentenyl, 3-methyl-3-pentenyl, 4-methyl-3-pentenyl, 1-methyl-4-pentenyl, 2-methyl-4-pentenyl, 3-methyl-4-pentenyl, 4-methyl-4-pentenyl, 1,1-dimethyl-2-butenyl, 1,1-dimethyl-3-butenyl, 1,2-dimethyl-1-butenyl, 1,2-dimethyl-2-butenyl, 1,2-dimethyl-3-butenyl, 1,3-dimethyl-1-butenyl, 1,3-dimethyl-2-butenyl, 1,3-dimethyl-3-butenyl, 2,2-dimethyl-3-butenyl, 2,3-dimethyl-1-butenyl, 2,3-dimethyl-2-butenyl, 2,3-dimethyl-3-butenyl, 3,3-dimethyl-1-butenyl, 3,3-dimethyl-2-butenyl, 1-ethyl-1-butenyl, 1-ethyl-2-butenyl, 1-ethyl-3-butenyl, 2-ethyl-1-butenyl, 2-ethyl-2-butenyl, 2-ethyl-3-butenyl, 1,1,2-trimethyl-2-propenyl, 1-ethyl-1-methyl-2-propenyl, 1-ethyl-2-methyl-1-propenyl and 1-ethyl-2-methyl-2-propenyl, wherein ethylene is preferred;

(2) C_4-C_{12}-alkdienyl such as 1,3-butadiene, 2-Methyl-1,3-butadien (=isoprene), 2,3-dimethyl-1,3-butadiene, 1,3-pentadiene, 2-methyl-1,3-pentadiene, 1,3-hexadiene, 4,5-diethyl-1,3-octadiene, 3-butyl-1,3-octadiene;

(3) C_4-C_{12}-haloalkdienyl such as 2-Chlor-1,3-butadien (=chloroprene);

(4) Styrene and styrene derivatives such as styrene, α-methyl styrene, o-methyl styrene, m-methyl styrene p-methyl styrene, p-t-butyl styrene, p-chloromethyl styrene, p-styrenesulfonic acid and its sodium or potassium salt, o-methoxystyrene, m-methoxystyrene, p-methoxystyrene;

(5) Amino group containing aromatic vinyl compounds such as dimethylaminostyrene, diethylaminostyrene;

(6) epoxy group containing unsaturated compounds; allylglycidylether, etc.
methyl pyrollidone;

(7) triallyl cyanurate;

(8) triallyl isocyanurate;

(9) diallyl phthalate;

(10) allyl sulfonate;

(11) Vinyl-derivaties such as vinylidene chloride, vinylidene fluoride, vinyl chloride, vinyl ethers such as ethyl vinyl ether, chloroethyl ether, perfluoropropyl vinyl ether;

(12) vinyl pyridines such as 2-vinylpyridine, 4- vinylpyridine;

(13) halogenated alkyl such as chlorotrifluoroethylene, tetrafluoroethylene, hexafluoropropylene;

(14) sodium isoprene sulfonate, dicyclopentadienyl, ethylidene norbornene, divinylbenezene;

(15) unsaturated alcohols; (meth)allylalcohol.

The distribution of Monomer 1 and Monomer 2 in the copolymer is either alternate, statistical or block by block.

Preferred copolymers are acrylate copolymers. Preferred acrylate copolymers are those comprising

(a) Monomer 1 selected from the group consisting of acrylic acid, methacrylic acid, itaconic acid; and

(b) Monomer 1 selected from the group consisting of alkyl (meth)acrylates such as methyl (meth)acrylate, ethyl (meth)acrylate, n-propyl (meth)acrylate, n-butyl meth)acrylate, t-butyl (meth)acrylate, lauryl (meth)acrylate, cyclohexyl (meth)acrylate 2-ethylhexyl (meth)acrylate, stearyl (meth)acrylate, dodecyl(meth)acrylate and (meth)acrylamides such as dimethyl(meth)acrylamide, diethyl(meth)acrylamide, isopropyl(meth)acrylamide,(meth)acryloyl morpholine, dimethylaminomethyl(meth)acrylamide, dimethylaminoethyl(meth)acrylamide, dimethylaminopropyl(meth)acrylamide, diethylaminomethyl(meth)acrylamide, diethylaminoethyl(meth)acrylamide, diethylaminopropyl(meth)acrylamide; or

(c) Monomer 2 selected from the group consisting of 2-hydroxyethyl acrylate, 2-hydroxypropyl acrylate, 2-hydroxyethyl methacrylate, 2-hydroxypropyl methacrylate, glycidyl (meth)acrylate; or

(d) Monomer 2 selected from the group consisting of styrene and styrene derivatives such as styrene, α-methyl styrene, o-methyl styrene, m-methyl styrene p-methyl styrene, p-t-butyl styrene, p-chloromethyl styrene, p-styrenesulfonic acid and its sodium or potassium salt, o-methoxystyrene, m-methoxystyrene, p-methoxystyrene;

Equally preferred copolymers are ethylene vinyl acetate copolymers consisting mainly of ethylene (Monomer 2) and vinyl acetate (Monomer 1),
in addition to vinyl acetate as Monomer 1, the Monomer 1 No. (1) can be used; and/or in addition to ethylene as Monomer 2, Monomer 2 No. (2) and/or Monomer 2 No. (3) and/or Monomer 2 No. (4) can be used.

The above-mentioned vinyl acetate copolymers may be also partially hydrolysed to the respective vinyl alcohols.

Further preferred polymers are styrene butadiene rubber latex polymers comprising Monomer 1 and Monomer 2, wherein
Monomer 1 No. (1) and/or Monomer 1 No.(2) and/or Monomer 1 No.(3) and/or Monomer 1 No.(4) and/or Monomer 1 No.(5) and/or Monomer 1 No.(6) and/or Monomer 1 No.(7) and/or Monomer 1 No.(8) and/or Monomer 1 No.(9) can be used; and
Monomer 2 No. (2), No. (12) or No (4) can be used; and
can be used.

Especially preferred are acrylate copolymers and ethylene vinyl acetate copolymers as defined above.

The polymers or copolymers set forth above have a glass transition temperature within the range of –40°C to 15°C, preferably in the range of –30°C to 10°C, more preferably –30°C to 5°C, most preferably –25°C to -5°C.

The glass transition temperature of the polymers, copolymers is determined by differential scanning calorimeter (DSC). All samples were dried at 110°C for one hour to eliminate the effect of water/solvent on Tg of copolymers. DSC sample size is about 10-15 mg. The measurement is usually carried out from –100°C to 100°C at 20°C/min under N_2-atomosphere. The Tg is determined by midpoint of the transition region:

All polymers, copolymers and waxes mentioned above, are herein below termed as "sticker" or "stickers".

The present invention comprises the use of a sticker for the preparation of a seed treatment formulation.

The pesticidal agent is either at least one fungicide or at least one insecticide or a mixture consisting of fungicide and at least one insecticide

The fungicide is selected from the group

- acylalanines such as benalaxyl, metalaxyl, ofurace, oxadixyl,
- amine derivatives such as aldimorph, dodine, dodemorph, fenpropimorph, fenpropidin, guazatine, iminoctadine, spiroxamin, tridemorph
- anilinopyrimidines such as pyrimethanil, mepanipyrim or cyrodinyl,
- antibiotics such as cycloheximid, griseofulvin, kasugamycin, natamycin, polyoxin or streptomycin,
- azoles such as bitertanol, bromoconazole, cyproconazole, difenoconazole, dinitroconazole, epoxiconazole, fenbuconazole, fluquiconazole, flusilazole, hexaconazole, imazalil, metconazole, myclobutanil, penconazole, propiconazole, prochloraz, prothioconazole, tebuconazole, triadimefon, triadimenol, triflumizol, triticonazole,
- dicarboximides such as iprodion, myclozolin, procymidon, vinclozolin,
- dithiocarbamates such as ferbam, nabam, maneb, mancozeb, metam, metiram, propineb, polycarbamate, thiram, ziram, zineb,
- heterocyclic compounds such as anilazine, benomyl, boscalid, carbendazim, carboxin, oxycarboxin, cyazofamid, dazomet, dithianon, famoxadon, fenamidon, fenarimol, fuberidazole, flutolanil, furametpyr, isoprothiolane, mepronil, nuarimol, probenazole, proquinazid, pyrifenox, pyroquilon, quinoxyfen, silthiofam, thiabendazole, thifluzamid, thiophanate-methyl, tiadinil, tricyclazole, triforine,
- copper fungicides such as Bordeaux mixture, copper acetate, copper oxychloride, basic copper sulfate,
- nitrophenyl derivatives such as binapacryl, dinocap, dinobuton, nitrophthalisopropyl
- phenylpyrroles such as fenpiclonil or fludioxonil,
- sulfur
- other fungicides such as acibenzolar-S-methyl, benthiavalicarb, carpropamid, chlorothalonil, cyflufenamid, cymoxanil, dazomet, diclomezin, diclocymet, diethofencarb, edifenphos, ethaboxam, fenhexamid, fentin-acetate, fenoxanil, ferimzone, fluazinam, fosetyl, fosetyl-aluminum, iprovalicarb, hexachlorobenzene, metrafenon, pencycuron, propamocarb, phthalide, tolclofos-methyl, quintozene, zoxamid, isoprothiolane, probenfos,
- strobilurins such as azoxystrobin, dimoxystrobin, fluoxastrobin, kresoxim-methyl, metominostrobin, orysastrobin, picoxystrobin, pyraclostrobin or trifloxystrobin,
- sulfenic acid derivatives such as captafol, captan, dichlofluanid, folpet, tolylfluanid,
- cinnemamides and analogs such as dimethomorph, flumetover or flumorp,
- amide fungicides such as cyclofenamid or (Z)-N-[α-(cyclopropylmethoxyimino)-2,3-difluoro-6-(difluoromethoxy)benzyl]-2-phenylacetamide;

preferably

benomyl, thiophanate-methyl, thiabendozole, ipconazole, triflumizole, pefurazoate, oxolinic acid, fludioxonil, thiram, copper hydroxide, copper oxide chloride, captan, ka-

sugamycin, orysastrobin, mepronil, flutolanil, tolclofos-methyl, oxytetracycline, iminoctadine, epoxiconazole, fluquinconazole, metconazole, prochloraz, triticonazole, probenazole, pyroquilon, acibenzolar-S-methyl, carpropamid, diclocymet, fenoxanil, azoxystrobin, dimoxystrobin, fluoxastrobin, kresoxim-methyl, metominostrobin, orysastrobin, picoxystrobin, pyraclostrobin or trifloxystrobin, tricyclazole, tiadinil, isoprothiolane, iprobenfos;

more preferably

benomyl, thiophanate-methyl, thiabendozole, ipconazole, triflumizole, prochloraz, pefurazoate, oxolinic acid, fludioxonil, thiram, copper hydroxide, copper oxide chloride, captan, kasugamycin, orysastrobin, probenazole, pyroquilon, acibenzolar-S-methyl, carpropamid, diclocymet, tiadinil, tricyclazole;

most preferably orysastrobin.

The insecticide is selected from the group

Organophosphates: Acephate, Azinphos-methyl, Chlorpyrifos, Chlorfenvinphos, Diazinon, Dichlorvos, dimethylvinphos, dioxabenzofos, Dicrotophos, Dimethoate, Disulfoton, Ethion, EPN, Fenitrothion, Fenthion, Isoxathion, Malathion, Methamidophos, Methidathion, Methyl-Parathion, Mevinphos, Monocrotophos, Oxydemeton-methyl, Paraoxon, Parathion, Phenthoate, Phosalone, Phosmet, Phosphamidon, Phorate, Phoxim, Pirimiphos-methyl, Profenofos, Prothiofos, primiphos-ethyl, pyraclofos, pyridaphenthion, Sulprophos, Triazophos, Trichlorfon; tetrachlorvinphos, vamidothion;

Carbamates: Alanycarb, Benfuracarb, Bendiocarb, Carbaryl, BPMC, carbofuran, Carbosulfan, Fenoxycarb, Furathiocarb, Indoxacarb, Methiocarb, Methomyl, Oxamyl, Pirimicarb, Propoxur, Thiodicarb, Triazamate;

Pyrethroids: Bifenthrin, Cyfluthrin, cycloprothrin, Cypermethrin, Deltamethrin, Esfenvalerate, Ethofenprox, Fenpropathrin, Fenvalerate, Cyhalothrin, Lambda-Cyhalothrin, Permethrin, Silafluofen, Tau-Fluvalinate, Tefluthrin, Tralomethrin, alpha-cypermethrin, zeta-cypermethrin, permethrin;

Neonicotinoides: acetamiprid, clothianidin, Dinotefuran, Flonicamid, Imidacloprid, Nitenpyram, Thiamethoxam, thiacloprid;

Arthropod growth regulators: a) chitin synthesis inhibitors: benzoylureas: Chlorfluazuron, Diflubenzuron, Flucycloxuron, Flufenoxuron, Hexaflumuron, Lufenuron, Novaluron, Teflubenzuron, Triflumuron; Buprofezin, Diofenolan, Hexythiazox,

Etoxazole, Clofentazine; b) ecdysone antagonists: Halofenozide, Methoxyfenozide, Tebufenozide; c) juvenoids: Pyriproxyfen, Methoprene, Fenoxycarb; d) lipid biosynthesis inhibitors: Spirodiclofen;

Various: Abamectin, Acequinocyl, Amitraz, Azadirachtin, bensultap Bifenazate, Cartap, Bensultap,Chlorfenapyr, Chlordimeform, Cyromazine, Diafenthiuron, Diofenolan, Emamectin benzoate, Endosulfan, Ethiprole, Fenazaquin, Fipronil, Formetanate, Formetanate hydrochloride, gamma-HCH Hydramethylnon, Indoxacarb, isoprocarb, metolcarb, nitenpyram, Pyridaben, Pymetrozine, Spinosad, Sulfur, Tebufenpyrad, Thiocyclam, XMC, xylylcarb, Pyridalyl;

preferably selected from the group consisting of

Acephate, Chlorpyrifos, Chlorfenvinphos, Malathion, Benfuracarb, Bendiocarb, carbofuran, Carbosulfan, Furathiocarb, Methiocarb, Thiodicarb; Bifenthrin, Tefluthrin, alpha-cypermethrin ,permethrin, acetamiprid, clothianidin, Dinotefuran, Ethiprole, Fipronil, gamma-HCH, Imidacloprid, Spinosad, Thiamethoxam and thiacloprid, Cartap, Bensultap, Thiocyclam, Nitenpyram, Buprofezin, Pymetrozine, Fenitrothion, Diazinon, BPMC, Fenthion, Flonicamid;

more preferably
Fipronil, Benfuracarb, Bendiocarb, Carbosulfan, Furathiocarb, Permethrin, Acetamiprid, Clothianidin, Dinotefuran, Ethiprole, Imidacroprid, Spinosad, Thiamethoxam, Thiacloprid, Emamectin benzoate;

most preferably Fipronil.

Furthermore, the formulation optionally comprises formulation auxiliaries such as

(a) surfactants such as Alkyl benzene sulfonate, polyoxyethylene fatty alcohol ethers, Lignosulfonate, Alkyl naphthalene sulfonate, Naphthalene sulfonate-formaldehyde condensate, Alkyl naphthalene sulfonate-formaldehyde condensate, Phenolsulfonic acid formaldehyde polycondensate as sodium salt, Polyoxyethylene alkyl ether, Polyoxyethylene alkyl ether sulfate, Polyoxyethylene alkyl ether phosphate, Polyoxyethylene alkyl phenyl ether, Polyoxyethylene alkyl phenyl ether sulfate, Polyoxyethylene alkyl aryl ether sulfate, Polyoxyethylene alkyl aryl ether phosphate, Polyoxyethylene alkyl aryl phenyl ether , Polyoxyethylene styrylphenylether sulfate, Polyoxyethylene styrylphenyl ether, Polyoxyethylene alkyl ester, Polyethylene glycol monomethyl ether, Polyoxyethylene sorbitan alkylate, Polyoxyethylene styrylphenyl ether polymer, Polyoxyalkylene gylcol, Polycarboxylates, Phenol sulfonates, Alkyl sulfates,

Dialkyl sulfosuccinates, Alkyl ether sulfates, Acetylene glycols and mixtures thereof, wherein mixtures of polyoxyethylene styrylphenylether, Sulfate and phenolsulfonic acid formaldehyde polycondensate as sodium salt are preferred;

(b) a solvent such as water, aromatic solvents (for example Solvesso products, xylene), paraffins (for example mineral fractions), alcohols (for example methanol, butanol, pentanol, benzyl alcohol), ketones (for example cyclohexanone, gamma-butyrolactone), pyrrolidones (NMP, NOP), DMSO, acetates (glycol diacetate), glycols, fatty acid dimethylamides, fatty acids and fatty acid esters. In principle, solvent mixtures may also be used; the preferred solvent is water;

(c) carriers (for solid formulation)/ filler or vehicle (for liquid formulation) such as ground natural minerals (for example kaolins, clays, talc, chalk), ground synthetic minerals (for example highly disperse silica, silicates) or solvents as listed above in (b);

(d) thickener (or agent of suspension) such as sodium carboxymethyl cellulose, methyl cellulose, ethyl cellulose, polyvinylalcohol, Sodium alginate, Sodium poly acrylate, Xanthan gum, Welan gum, Gum arabic, Montmorillonite, Lignosulfonates, Hydroxy methyl cellulose, Dextrin, Starch and mixtures thereof;

(e) anti-freezing agents such as glycerin, ethylene glycol, propylene glycol, preferably propylene glycol

(f) anti-foaming agents such as Silicone oils, mineral oils, Fatty acid ester;

(g) biocide such as sodium benzoate, 1,2-benzisothiazoline –3-one, 2-methyl-4-isothiazolin-3-one, 5-chloro-2-methyl-4-isothiazolin-3-one, potassium sorbate, parahydroxy benzoates, The preferred biocides are 1,2-benzisothiazoline-3-one and 2-methyl-4-, isothiazolin-3-one.

Optionally, also pigments can be included in the formulation. Suitable pigments or dyes for seed treatment formulations are pigment blue 15:4, pigment blue 15:3, pigment blue 15:2, pigment blue 15:1, pigment blue 80, pigment yellow 1, pigment yellow 13, pigment red 112, pigment red 48:2, pigment red 48:1, pigment red 57:1, pigment red 53:1, pigment orange 43, pigment orange 34, pigment orange 5, pigment green 36, pigment green 7, pigment white 6, pigment brown 25, basic violet 10, basic violet 49, acid red 51, acid red 52, acid red 14, acid blue 9, acid yellow 23, basic red 10, basic red 108.

Conventional seed treatment formulations include for example flowable concentrates FS, solutions LS, powders for dry treatment DS, water dispersible powders for slurry treatment WS, water-soluble powders SS and emulsion ES. Application to the seeds is

carried out before sowing, either directly on the seeds or after having pregerminated the latter, more preferably as FS formulation.

In the seed treatment formulation the amount of sticker is between 0.1 and 15 % (w/w), preferably between 0.5 and 10 % (w/w), most preferably 0.5-5%.

The amounts of the pesticidal agent and formulation auxiliaries vary from formulation type to formulation type. The skilled artisan is familiar with the determination of the amounts necessary for the respective formulation.

For example, a FS formulation for rice preferably comprises; from 0.5 to 80% of the pesticidal agent; from 0.5 to 20 % of a surfactant (a); from 0.1 to 5 % of a thickener (d); from 5 to 20 % of an anti-freeze agent (e); from 0.1 to 2 % of an anti-foam agent (f); from 0% to 75 % of a filler/vehicle (c); and from 0.01 to 1 % of a biocide (g); and ; from 0 to 20 % of a pigment and/or a dye.

A FS formulation for rice seed treatment formulation typically comprises; from 0.5 to 80% of the pesticidal agent; from 0.5 to 20 % of a surfactant (a); from 0.1 to 5 % of a thickener (d); from 5 to 20 % of an anti-freeze agent (e); from 0,1 to 2 % of an anti-foam agent (f); from 0% to 75 % of a filler/vehicle (c); and from 0.01 to 1 % of a biocide (g).

The preparation of the respective formulations is known by the skilled artisan (see e.g. for review US 3,060,084, EP-A 707 445 (for liquid concentrates), Browning, "Agglomeration", Chemical Engineering, Dec. 4, 1967, 147-48, Perry's Chemical Engineer's Handbook, 4th Ed., McGraw-Hill, New York, 1963, pages 8-57 and et seq. WO 91/13546, US 4,172,714, US 4,144,050, US 3,920,442, US 5,180,587, US 5,232,701, US 5,208,030, GB 2,095,558, US 3,299,566, Klingman, Weed Control as a Science, John Wiley and Sons, Inc., New York, 1961, Hance et al., Weed Control Handbook, 8th Ed., Blackwell Scientific Publications, Oxford, 1989 and Mollet, H., Grubemann, A., Formulation technology, Wiley VCH Verlag GmbH, Weinheim (Germany), 2001.

The sticker can be used in form of an emulsion, dispersion or solution in a solvent as defined above.

In one embodiment of the invention, a seed treatment formulation can be prepared based on the sticker, pesticidal agent and optionally the formulation auxiliaries.

In an other embodiment of the invention, a formulation can be prepared based on the pesticidal agent and optionally the formulation auxiliaries mentioned above in a first step. Alternatively, a commercial available formulation can be used. In a second step, the sticker is added to the prepared formulation comprising at least one pesticidal

agent and the formulation auxiliaries or to the commercial available formulation. This method is suitable not only for solid formulations, which are, in a first step dispersed in water, to which afterwards the sticker is added, but also for the liquid formulations, which are, in a first step dispersed/diluted in water, to which afterwards the sticker is added.

In an other embodiment, the formulation comprising formulation auxilaries and at least one pesticidal agent (or a commercial available formulation) and a sticker solution are applied to the seeds together or consecutively.

All embodiments of the seed treatment formulation mentioned above are herein below termed as "formulation according to the invention".

The formulation according to the invention can be used for the treatment of crop seeds such as those selected from the group of field crop seeds, such as corn (sweet and field), soybean, wheat, barley, oats, rye, triticale, rice, cotton, sunflower, potato, pasture, alfalfa, grasses, turf, sorghum, rapeseed, Brassica spp., and sugar beet, vegetable crop seeds, such as tomato, lettuce, iceberg lettuce, pepper, cucumber, squash, melon, bean, peas, leek, garlic, onion, cabbage, carrot, special crops seeds, such as tobacco, and ornamental seed, for example, pansy, impatiens, petunia and geranium, preferably vegetable crop seeds, sugar beet, corn and rice; most preferably rice.

The invention furthermore comprises seeds treated with a formulation according to the invention, wherein preferably the seeds are selected from the group consisting of the group of field crop seeds, such as corn (sweet and field), soybean, wheat, barley, oats, rye, triticale, rice, cotton, sunflower, potato, pasture, alfalfa, grasses, turf, sorghum, rapeseed, Brassica spp., and sugar beet, vegetable crop seeds, such as tomato, lettuce, iceberg lettuce, pepper, cucumber, squash, melon, bean, peas, leek, garlic, onion, cabbage, carrot, special crops seeds, such as tobacco, and ornamental seed, for example, pansy, impatiens, petunia and geranium, preferably vegetable crop seeds, sugar beet, corn and rice; most preferably rice.

The invention furthermore comprises a method for the treatment of seeds prior sowing with a formulation according to the present invention comprising the following steps:

a) applying to a solvent a formulation according to according to the invention; and

b) applying to a seed the mixture obtained in step a).

In a preferred embodiment, the solvent is water. As mentioned above, it is also possible to apply a formulation (e.g. a commercial available formulation) and the sticker

separately to the seeds, which means that formulation and a sticker, which is optionally diluted in a solvent e.g. water are applied together or in succession.

For use in treating seeds, the typical rate of application of the pesticidal agent is from 0,1 gm to 10 kilogram of pesticidal agent per 100kg of seeds, desirably from 1 g to 5 kg pesticidal agent per 100 kg of seeds, more desirably from 1 g to 2 kg per 100 kg of seeds.

In a preferred embodiment, there are basically four methods for the treatment of seeds with a formulation according to the invention, namely submergence, coating, dry seed treatment and spray seed treatment (for review see e.g. Japan Plant Protection Association (p. 133-139 "Pesticide Application Technology", 1998; ASGROW Reports: Seed treatments: Trends and Opportunities, 2002):

1. Submergence is most commonly applied for rice seed. According to the method, rice seed is submerged in salt water to eliminate not-suitable seed and salt water is removed. The seed is washed with fresh water and packed in a bag that is sunk into the equivalent volume of chemical solution with seed volume, wherein the chemical solution normally is obtained by the dilution of a formulation such as FS, LS, DS, WS, SS and ES. Afterwards, the seed are dried.

2. Coating is most commonly used for rice, vegetable, potato, bulb. According to this method, the respective seeds are submerged in salt water to eliminate not suitable seed. After removal of the salt water, the seeds are washed and afterwards coated with a diluted formulation (e.g. 0,5% of WP formulation in water) by using rotating pot-mixer for about three minutes and followed by reversible rotation. Afterwards, the seeds are dried.

3. For dried seed treatment, a slightly diluted formulation is diluted with water in a mixer (e.g. 2% water is added with WP in a mixer), the seeds are afterwards added, incubated.

4. Spray seed treatment is a method usually used for treating large volume of rice seeds. For this purpose, a solution obtained by dilution of a formulation (e.g. a FS, LS, DS, WS, SS and ES) is sprayed continuously on seed in a spray chamber automatically measured and supplied from hopper, then dried at elevated temperature (e.g. 40°C) in dryer room.

In a further preferred embodiment of the invention, the seeds can treated with a formulation according to the present invention in a seed priming process (for review see: ASGROW Reports: Seed treatments: Trends and Opportunities, 2002; Khan et al.:

International Journal of Agricultural Botany, 2003; SeedQuest@seedquest.com. Typically, such process comprises the following steps:

- hydration of seeds followed by germination of seeds under controlled conditions;

- treatment of seeds with a formulation according to the present invention;

wherein depending on the respective process the hydration can be done in first and the treatment of seeds with a formulation according to the present invention in a second step or, alternatively, the treatment of seeds with a formulation according to the present invention can be done first followed by the hydration of seeds.

The treatment of seeds with a formulation according to the present invention can be done as explained above.

Priming or "pre-sowing hydration treatment" is a seed enhancement process for improving the germination characteristics of seeds. Priming is accomplished by partially hydrating seed and maintaining it under defined moisture, temperature and aeration conditions for a prescribed period of time. For such process, the seeds are treated with precisely controlled conditions to allow most events of germination to occur while preventing the seeds from actually sprouting. The process involves the use of normal, natural conditions, that are controlled in a way to manipulate the activities in the seed. Generally, seeds priming can be conducted through

(1) humidification
(2) hydro-priming
(3) osmotic priming
(4) alternate hydration-dehydration

In this state, the seeds are hydrated and desirable metabolic activity is switched on. This triggers important pre-germination physiological steps, such as repair of membranes, DNA and RNA synthesis and repair, development of immature embryos, alteration of tissues covering the embryo, destruction or removal of dormancy blocks and general pre-germination metabolism enhancement. At the conclusion of the priming process, the seed is re-dried to its storage moisture level to promote good storage. It is understood that once the framework for actual germination is built and the seeds are dried down to stable moisture levels, planting of the seeds in the field will activate the final germination process through contact with moisture in the soil or cultivation media.

The gains made in priming are not lost following dry-back of the seed. Following the priming process, seed is physiologically closer to germination because of the following

reasons (see for review ASGROW Reports: Seed treatments: Trends and Opportunities, 2002; Khan et al.: International Journal of Agricultural Botany, 2003):

(1) Reduction of germination time in the field
(2) Overcoming of dormancy effects
(3) Induction of good germination under more stressful field conditions
(4) Quicker field emergence
(5) Faster crop establishment
(6) Seed disinfections

The term "pre-sowing hydration treatment" includes

a) non-controlled (such as soaking methods in which water is freely available and not restricted by the environment) and

b) controlled water uptake (such as methods that regulate seed moisture content preventing the completion of germination).

Two techniques can be used for non-controlled water uptake:
(1) priming or soaking with solutions; and/or
(2) priming or soaking with solid particulate systems.

Three techniques can be used for controlled water uptake (see for review ASGROW Reports: Seed treatments: Trends and Opportunities, 2002; Khan et al.: International Journal of Agricultural Botany, 2003; Seed Quest @ seedquest.com):

(1) priming with solutions;
(2) priming with solid particulate systems; and/or
(3) priming by controlled hydration with water.

In a particular preferred embodiment, the seeds treated with a formulation according to the invention are used in a non-controlled seed priming or soaking process for rice (N. Slaton and R Cartwright: Water-Seeded Rice. in: Rice Production Handbook, University of Arkansas Publication, Arkansas, USA).

In seed priming process, especially in a non-controlled seed priming process for rice seeds treated with a formulation according to the invention a prolonged protection of the seed against phytopathogenic fungi and insects up to 120 days can be achieved, which is superior to the nursery box treatment.

In seed priming process, especially in a rice seed priming process seeds treated with a formulation according to the invention a prolonged protection of the seed against phy-

topathogenic fungi and insects up to 120 days can be achieved, which is superior to the nursery box treatment.

The term phytopathogenic fungi includes but is not limited to
Alternaria species on vegetables and fruit and rice,
Bipolaris and *Drechslera* species on cereals, rice and turf,
Blumeria graminis (powdery mildew) on cereals,
Botrytis cinerea (gray mold) on strawberries, vegetables, ornamentals and grapevines,
Erysiphe cichoracearum and *Sphaerotheca fuliginea* on cucurbits,
Fusarium and *Verticillium* species on various plants,
Mycosphaerella species on cereals, bananas and peanuts,
Phytophthora infestans on potatoes and tomatoes,
Plasmopara viticola on grapevines,
Podosphaera leucotricha on apples,
Pseudocercosporella herpotrichoides on wheat and barley,
Pseudoperonospora species on hops and cucumbers,
Puccinia species on cereals,
Pyricularia oryzae, Cochliobolus miyabeanus and *Corticium sasakii* (*Rhizoctonia solani*), *Fusarium semitectum* (and/or *moniliforme*), *Helminth.* Spp, *Cercospora oryzae, Cochliobolus miyabeanus, Sarocladium oryzae, S attenuatum, Entyloma oryzae, Gibberella fujikuroi (bakanae), Grainstaining* complex (various pathogens), and/or *Pythium* on rice,
Rhizoctonia species on cotton, rice and turf,
Septoria tritici and *Stagonospora nodorum* on wheat,
Uncinula necator on grapevines,
Ustilago species on cereals and sugar cane, and
Venturia species (scab) on apples and pears;

preferably the species
Alternaria ssp., Pyricularia oryzae, Cochliobolus miyabeanus and *Corticium sasakii* (*Rhizoctonia solani*), *Fusarium semitectum* (and/or *moniliforme*), *Helminth.* Spp, *Cercospora oryzae, Cochliobolus miyabeanus, Sarocladium oryzae, S attenuatum, Entyloma oryzae, Gibberella fujikuroi (bakanae), Grainstaining* complex (various pathogens), and/or *Pythium* on rice.

The term phytopathogenic insect includes but is not limited to
insects from the order of the lepidopterans (*Lepidoptera*), for example *Agrotis ypsilon, Agrotis segetum, Alabama argillacea, Anticarsia gemmatalis, Argyresthia conjugella, Autographa gamma, Bupalus piniarius, Cacoecia murinana, Capua reticulana, Cheimatobia brumata, Choristoneura fumiferana, Choristoneura occidentalis, Cirphis unipuncta, Cydia pomonella, Dendrolimus pini, Diaphania nitidalis, Diatraea grandiosella, Earias insulana, Elasmopalpus lignosellus, Eupoecilia ambiguella, Evetria bou-*

liana, Feltia subterranea, Galleria mellonella, Grapholitha funebrana, Grapholitha molesta, Heliothis armigera, Heliothis virescens, Heliothis zea, Hellula undalis, Hibernia defoliaria, Hyphantria cunea, Hyponomeuta malinellus, Keiferia lycopersicella, Lambdina fiscellaria, Laphygma exigua, Leucoptera coffeella, Leucoptera scitella, Lithocolletis blancardella, Lobesia botrana, Loxostege sticticalis, Lymantria dispar, Lymantria monacha, Lyonetia clerkella, Malacosoma neustria, Mamestra brassicae, Orgyia pseudotsugata, Ostrinia nubilalis, Panolis flammea, Pectinophora gossypiella, Peridroma saucia, Phalera bucephala, Phthorimaea operculella, Phyllocnistis citrella, Pieris brassicae, Plathypena scabra, Plutella xylostella, Pseudoplusia includens, Rhyacionia frustrana, Scrobipalpula absoluta, Sitotroga cerealella, Sparganothis pilleriana, Spodoptera frugiperda, Spodoptera littoralis, Spodoptera litura, Thaumatopoea pityocampa, Tortrix viridana, Trichoplusia ni and *Zeiraphera canadensis*,

beetles (*Coleoptera*), for example *Agrilus sinuatus, Agriotes lineatus, Agriotes obscurus, Amphimallus solstitialis, Anisandrus dispar, Anthonomus grandis, Anthonomus pomorum, Atomaria linearis, Blastophagus piniperda, Blitophaga undata, Bruchus rufimanus, Bruchus pisorum, Bruchus lentis, Byctiscus betulae, Cassida nebulosa, Cerotoma trifurcata, Ceuthorrhynchus assimilis, Ceuthorrhynchus napi, Chaetocnema tibialis, Conoderus vespertinus, Crioceris asparagi, Diabrotica longicornis, Diabrotica 12-punctata, Diabrotica virgifera, Epilachna varivestis, Epitrix hirtipennis, Eutinobothrus brasiliensis, Hylobius abietis, Hypera brunneipennis, Hypera postica, Ips typographus, Lema bilineata, Lema melanopus, Leptinotarsa decemlineata, Limonius californicus, Lissorhoptrus oryzophilus, Melanotus communis, Meligethes aeneus, Melolontha hippocastani, Melolontha melolontha, Oulema oryzae, Ortiorrhynchus sulcatus, Otiorrhynchus ovatus, Phaedon cochleariae, Phyllotreta chrysocephala, Phyllophaga sp., Phyllopertha horticola, Phyllotreta nemorum, Phyllotreta striolata, Popillia japonica, Sitona lineatus* and *Sitophilus granaria*,

dipterans (*Diptera*), for example *Aedes aegypti, Aedes vexans, Anastrepha ludens, Anopheles maculipennis, Ceratitis capitata, Chrysomya bezziana, Chrysomya hominivorax, Chrysomya macellaria, Contarinia sorghicola, Cordylobia anthropophaga, Culex pipiens, Dacus cucurbitae, Dacus oleae, Dasineura brassicae, Fannia canicularis, Gasterophilus intestinalis, Glossina morsitans, Haematobia irritans, Haplodiplosis equestris, Hylemyia platura, Hypoderma lineata, Liriomyza sativae, Liriomyza trifolii, Lucilia caprina, Lucilia cuprina, Lucilia sericata, Lycoria pectoralis, Mayetiola destructor, Musca domestica, Muscina stabulans, Oestrus ovis, Oscinella frit, Pegomya hysocyami, Phorbia antiqua, Phorbia brassicae, Phorbia coarctata, Rhagoletis cerasi, Rhagoletis pomonella, Tabanus bovinus, Tipula oleracea* and *Tipula paludosa*,

thrips (*Thysanoptera*), e.g. *Frankliniella fusca, Frankliniella occidentalis, Frankliniella tritici, Scirtothrips citri, Thrips oryzae, Thrips palmi* and *Thrips tabaci*,

hymenopterans (*Hymenoptera*), e.g. *Athalia rosae, Atta cephalotes, Atta sexdens, Atta texana, Hoplocampa minuta, Hoplocampa testudinea, Monomorium pharaonis, Solenopsis geminata* and *Solenopsis invicta*,

heteropterans (*Heteroptera*), e.g. *Acrosternum hilare, Blissus leucopterus, Cyrtopeltis notatus, Dysdercus cingulatus, Dysdercus intermedius, Eurygaster integriceps, Euschistus impictiventris, Leptoglossus phyllopus, Lygus lineolaris, Lygus pratensis, Nezara viridula, Piesma quadrata, Solubea insularis* and *Thyanta perditor*,

homopterans (*Homoptera*), e.g. *Acyrthosiphon onobrychis, Adelges laricis, Aphidula nasturtii, Aphis fabae, Aphis forbesi, Aphis pomi, Aphis gossypii, Aphis grossulariae, Aphis schneideri, Aphis spiraecola, Aphis sambuci, Acyrthosiphon pisum, Aulacorthum solani, Brachycaudus cardui, Brachycaudus helichrysi, Brachycaudus persicae, Brachycaudus prunicola, Brevicoryne brassicae, Capitophorus horni, Cerosipha gossypii, Chaetosiphon fragaefolii, Cryptomyzus ribis, Dreyfusia nordmannianae, Dreyfusia piceae, Dysaphis radicola, Dysaulacorthum pseudosolani, Dysaphis plantaginea, Dysaphis pyri, Empoasca fabae, Hyalopterus pruni, Hyperomyzus lactucae, Macrosiphum avenae, Macrosiphum euphorbiae, Macrosiphon rosae, Megoura viciae, Melanaphis pyrarius, Metopolophium dirhodum, Myzodes persicae, Myzus ascalonicus, Myzus cerasi, Myzus varians, Nasonovia ribis-nigri, Nilaparvata lugens, Pemphigus bursarius, Perkinsiella saccharicida, Phorodon humuli, Psylla mali, Psylla piri, Rhopalomyzus ascalonicus, Rhopalosiphum maidis, Rhopalosiphum padi, Rhopalosiphum insertum, Sappaphis mala, Sappaphis mali, Schizaphis graminum, Schizoneura lanuginosa, Sitobion avenae, Trialeurodes vaporariorum, Toxoptera aurantiiand,* and *Viteus vitifolii;*

termites (*Isoptera*), e.g. *Calotermes flavicollis, Leucotermes flavipes, Reticulitermes lucifugus* und *Termes natalensis*;

orthopterans (*Orthoptera*), e.g. *Acheta domestica, Blatta orientalis, Blattella germanica, Forficula auricularia, Gryllotalpa gryllotalpa, Locusta migratoria, Melanoplus bivittatus, Melanoplus femur-rubrum, Melanoplus mexicanus, Melanoplus sanguinipes, Melanoplus spretus, Nomadacris septemfasciata, Periplaneta americana, Schistocerca americana, Schistocerca peregrina, Stauronotus maroccanus* and *Tachycines asynamorus ;*

Arachnoidea, such as arachnids (*Acarina*), e.g. of the families *Argasidae, Ixodidae* and *Sarcoptidae*, such as *Amblyomma americanum, Amblyomma variegatum, Argas persicus, Boophilus annulatus, Boophilus decoloratus, Boophilus microplus, Dermacentor silvarum, Hyalomma truncatum, Ixodes ricinus, Ixodes rubicundus, Ornithodorus moubata, Otobius megnini, Dermanyssus gallinae, Psoroptes ovis, Rhipicephalus appendiculatus, Rhipicephalus evertsi, Sarcoptes scabiei,* and Eriophyidae spp. such as *Aculus schlechtendali, Phyllocoptrata oleivora* and *Eriophyes sheldoni*; Tarsonemidae spp.

such as *Phytonemus pallidus* and *Polyphagotarsonemus latus*; Tenuipalpidae spp. such as *Brevipalpus phoenicis;* Tetranychidae spp. such as *Tetranychus cinnabarinus, Tetranychus kanzawai, Tetranychus pacificus, Tetranychus telarius* and *Tetranychus urticae*, *Panonychus ulmi, Panonychus citri, and oligonychus pratensis;*

Nematodes, especially plant parasitic nematodes such as root knot nematodes, *Meloidogyne hapla, Meloidogyne incognita, Meloidogyne javanica*, and other Meloidogyne species; cyst-forming nematodes, *Globodera rostochiensis* and other Globodera species; *Heterodera avenae, Heterodera glycines, Heterodera schachtii, Heterodera trifolii*, and other Heterodera species; Seed gall nematodes, Anguina species; Stem and foliar nematodes, Aphelenchoides species; Sting nematodes, *Belonolaimus longicaudatus* and other Belonolaimus species; Pine nematodes, *Bursaphelenchus xylophilus* and other Bursaphelenchus species; Ring nematodes, Criconema species, Criconemella species, Criconemoides species, Mesocriconema species; Stem and bulb nematodes, *Ditylenchus destructor, Ditylenchus dipsaci* and other Ditylenchus species; Awl nematodes, Dolichodorus species; Spiral nematodes, *Heliocotylenchus multicinctus* and other Helicotylenchus species; Sheath and sheathoid nematodes, Hemicycliophora species and Hemicriconemoides species; Hirshmanniella species; Lance nematodes, Hoploaimus species; false rootknot nematodes, Nacobbus species; Needle nematodes, *Longidorus elongatus* and other Longidorus species; Lesion nematodes, *Pratylenchus neglectus, Pratylenchus penetrans, Pratylenchus curvitatus, Pratylenchus goodeyi* and other Pratylenchus species; Burrowing nematodes, *Radopholus similis* and other Radopholus species; Reniform nematodes, *Rotylenchus robustus* and other Rotylenchus species; Scutellonema species; Stubby root nematodes, *Trichodorus primitivus* and other Trichodorus species, Paratrichodorus species; Stunt nematodes, *Tylenchorhynchus claytoni*, Tylenchorhynchus dubius and other Tylenchorhynchus species; Citrus nematodes, Tylenchulus species; Dagger nematodes, Xiphinema species; and other plant parasitic nematode species ;

and rice pathogens such as
Rice water weevil (*Lissorhoptrus oryzaphilus)*, rice stem borer (*Chilo suppresalis)*, rice leaf roller
rice leaf beetle, rice leaf miner (Agromyca oryzae), leafhoppers (*Nephotettix spp.;especially* smaller brown leafhopper, green rice leafhopper), planthoppers (*Delphacidae;* especially white backed planthopper, brown rice planthopper), stinkbugs;

preferably the rice pathogens:

Rice water weevil (*Lissorhoptrus oryzaphilus)*, rice stem borer (*Chilo suppresalis)*, rice leaf roller, rice leaf beetle, rice leaf miner (Agromyca oryzae), leafhoppers (*Nephotettix spp.;especially* smaller brown leafhopper, green rice leafhopper), planthoppers (*Delphacidae;* especially white backed planthopper, brown rice planthopper), stinkbugs.

The invention furthermore comprises a method for combating soil insects and/or fungi comprising applying a formulation according the invention to seeds prior sowing.

The seeds are treated with of the pesticidal agent in a range from 0,1 g to 10 kg of pesticidal agent per 100kg of seeds, desirably from 1 g to 5 kg pesticidal agent per 100kg of seeds, more desirably from 1 g to 2 kg per 100 kg of seeds.

The invention furthermore comprises a method for combating soil born insects and/or fungi comprising applying a formulation according the invention to seeds prior sowing.

The invention is illustrated in greater detail by the examples which follow.

Examples

Example 1

The trade names of the stickers are compiled in Table 1.

Table 1

Trade name of the sticker / water emulsion	Supplier	Contents (w/w %)	Chemical name
Acronal YJ2810Dap	BASF	50	Copolymer with acryl, alkyl-acrylate, alkyl-methacrylate
Repacks A-240	Toho Chemical	30	Paraffin and carnauba wax emulsion
Polysol OLZ 1094	Showa Highpolymer	50	Alkyl-acrylate copolymer
Lawnfix 700	Showa Highpolymer	50	Ethylene vinylacetate copolymer
Polysol AG-100	Showa Highpolymer	50	Alkyl-acrylate copolymer
Polysol AT-860	Showa Highpolymer	50	Alkyl-acrylate copolymer

A) Preparation of FS formulations

Table 2 Formulations

No.	FS formulation	Content
1	Orysastrobin FS formulation (500g orysastrobin/l)	A FS formulation comprising orysastrobin as pesticidal agent a condensate of phenolsulfonic acid, urea and formaldehyde and POE styrylphenyl ether as surfactants, a Silicone oil emulsion as antifoaming agent, propylene glycol as antifreezing agent, Xanthan gum as thickener and 1,2-benzisothiazolin-3-one and 2-methyl-4-isothiazolin-3-one as biocide and water as filler/vehicle
2	Metrafenone FS formulation (500g metrafenone/l)	A FS formulation comprising metrafenone as pesticidal agent, methylnaphthalene sulfonic acid, polymer with formaldhyde, sodium salt and polyoxyethylene-block-polyoxypropylene as surfactants, a Silicone oil emulsion as antifoaming agent, propylene glycol as antifreezing agent, Xanthan gum as thickener and benzisothiazolinone as biocide and water as filler/vehicle
3	(Z)-N-[α-(cyclopropyl-methoxyimino)-2,3-difluoro-6-(difluoromethoxy)benzyl]-2-phenylacetamide FS formulation (100g (Z)-N-[α-(cyclopropylmethoxyimino)-2,3-difluoro-6-(difluoro-methoxy)benzyl]-2-phenyl-acetamide / l)	A FS formulation comprising Z)-N-[α-(cyclopropyl-methoxyimino)-2,3-difluoro-6-(difluoromethoxy)benzyl]-2-phenylacetamide as pesticidal agent (c.f. EP-A 1017670), phenol sulfonic acid, polymer with formaldhyde and urea, sodium salt and polyoxyethylene-block-polyoxypropylene as surfactants, a Silicone oil emulsion as antifoaming agent, propylene glycol as antifreezing agent, Xanthan gum as thickener and benzisothiazolinone as biocide and water as filler/vehicle
4	fluquinconazole FS formulation (100g fluquinconazole/l)	commercial available FS formulation (Jockey)
5	triticonazole FS formulation (25g triticonazole/l)	commercial available FS formulation (Premis)

A-1) Preparation of suspension concentrate of Table 2

Approx. 400 ml of water were introduced into a container, and the amounts of the formulation auxiliaries (surfactants and antifoam) and fungicide (orysastrobin) listed in table 2 were added and the mixture was homogenized. The resulting suspension is ground by means of a wet beads mill, and thickened with the amount of thickener and Biocide (see table 2), which had been predispersed in 98 ml of water. The volume of the suspension was made up to 1000 ml with water and antifreezing agent.

Example 2

A) Coating of Rice Seeds

For Rice Seed Coating, a 3.2 ml FS-formulation having the composition indicated in table 2 is stirred with the respective sticker solution listed in table 1 and diluted with 5 – 7 ml water for 100 g rice seed. The resulting aqueous suspension and water are dropped onto the tumbling seeds in a tumbler [TY-NEE Tumbler (A. E. Aubin)] and incubated for 5 – 10min. Afterwards, the coated seeds are completely dried by air at room temperature.

B) Determination of efficiency of rice seed coating

5g of the seeds coated according to A) 1 were soaked into one liter of water at room temperature (20 °C) and the remaining active ingredient on seeds was assayed by extraction periodically at 2 days, 5 days and 8 days. According to the normal rice seed germination process, the whole water was replaced by fresh water at 3 days and 6 days, twice during seed soaking in order to supply oxygen to seeds. The results shown in Table 3 demonstrate that seeds coated with sticker showed excellent remaining rate (>80%) of active ingredients on the seeds after eight days soaking with water replaced twice, whereas seeds without sticker showed only a low remaining rate.

Table 3

Formulation [a.i.]	Sticker	Amount of a.i. [g][2)]	Amount of sticker [g][2]	Remaining a.i. [%]
orysatrobin [1)]	Acronal	500	33	92.76
orysatrobin [1)]	Lawnfix	500	33	85.2
orysatrobin [1)]	Polysol	500	33	85.1
orysatrobin [1)]	None	500	33	50.9

[1)] FS formulation of table 2

[2)] g/32kg seed

Example 3

A) Coating of Wheat Seeds

For 100 g wheat seed coating, the respective FS formulation is diluted with a small amount of water. The FS formulation and respective sticker emulsion are dropped onto the tumbling seeds in a tumbler and incubated for 15-20 min.

Afterwards, the coated seeds are dried by air at room temperature (25°C).

B) - Determination of efficiency of wheat seed coating

As indicated in table 4, the seeds coated with sticker showed excellent remaining rate (>80%) of active ingredients on the seeds after 24h soaking with water at room temperature, whereas seeds without sticker showed only a low remaining rate.

Table 4

Formulation [a.i.]	Sticker	Amount of a.i [1)]	Amount of sticker [1)]	Remaining a.i. [%]
fluquincozale FS formulation [2)]	none	150	-	27.3
fluquincozale FS formulation [2)]	Lawnfix 700	150	3	99.6
fluquincozale FS formulation [2)]	Acronal YJ2810Dap	150	3	98.9
triticonazole FS formulation [3)]	none	60	-	24.1
triticonazole FS formulation [3)]	Lawnfix 700	60	3	87.2
triticonazole FS formulation [3)]	Acronal YJ2810Dap	60	3	88.4
Z)-N-[α-(cyclopropylmethoxyimino)-2,3-difluoro-6-(difluoromethoxy)benzyl]-2-phenylacetamide FS formulation [4)]	none	50	3	29.2
Z)-N-[α-(cyclopropylmethoxyimino)-2,3-difluoro-6-(difluoromethoxy)benzyl]-2-phenylacetamide FS formulation [4)]	Lawnfix 700	50	3	84.8
Z)-N-[α-(cyclopropylmethoxyimino)-2,3-difluoro-6-(difluoromethoxy)benzyl]-2-phenylacetamide FS formulation [4)]	Acronal YJ2810Dap	50	3	94.0
metrafenone FS formulation [5)]	none	500	-	54.1
metrafenone FS formulation [5)]	Lawnfix 700	500	3	91.7
metrafenone FS formulation [5)]	Acronal YJ2810Dap	500	3	94.4

[1)] [g]/per 100 kg seeds
[2)] see table 2, No. 4
[3)] see table 2, No. 5
[4)] see table 2, No. 3
[5)] see table 2, No. 2

Example 4 - Determination of efficiency of seed coating

Rice seeds of rice cv. Koshihikari coated according to Example 2 A were soaked in the solution with the standard seed disinfectants ipconazole and copper hydroxide) to control seed-born diseases, and then soaked in water until germination. After seed disinfection, rice seeds soaked in water until germination characterized by plumule just breaking seed hull. The germinated seeds are seeded on bed soil in a seedling box (normally 30 x 60 x 3 cm) at desired seeding density and covered with topsoil. After seeding, the seedling boxes are incubated at desired temperature (normally ranging 25-30 C) till emergence characterized by coleoptile breaking the soil surface. After confirming the emergence, the seedling boxes are transferred to the place under light to continue seedling nursery till transplanting.

In the field, blast-infected (*Pyricularia oryzae*) rice seedlings were transplanted throughout the rice field. As for sheath blight, mycelia as inoculated were spread in the rice field.

For assessment of the data, the damage index of sheath blight was computed after standard (Hashiba method), which is based on the evaluation on the number of infected plants and vertical development of the disease symptoms in the certain sampling plot. The determination of panicle blast has been made by counting the number of panicles attached by neck blast and ranked by classes.

The data summarized in table 5 showed that the seeds coated with a sticker according to the invention were nearly not affected by the rice blast.

Table 5

Formulation [a.i. (amount [1])]	Sticker (amount[1])	Efficacy % [2] Leaf blast [3]	Efficacy % [2] Panicle blast [3]	Efficacy % [2] Sheath blight [4]
[orysastrobin (500)]	LAWNFIX (33)	97	84	99
[orysastrobin (500)]	POLYSOL (33)	97	80	99
[orysastrobin (500)]	REPACKS (33)	96	68	94
Untreated[3]	0	0[5]	0[5]	0[5]

[1] g / 32 kg seed; FS formulation (see table 2, No. 1)

[2] Control percentage = (infection of the untreated - infection of treatment)/(infection of the untreated) x 100

[3] Pyricularia oryzae

[4] Cortitium sasakii

[5] 21.7% infection

Claims

1. A seed treatment formulation comprising

(a) at least one pesticidal agent; and

(b) a carboxyl group containing polymer or copolymer or wax, wherein the carboxyl groups are selected from the group consisting of –C(O)OH or –C(O)OR^1, R^{2}O C(O)– wherein R^1 and R^2 is C_1-C_{40} Alkyl.

2. A seed treatment formulation according to claim 1, comprising

(a) at least one pesticidal agent; and

(b) a carboxyl group containing polymer or copolymer wherein the carboxyl groups are selected from the group consisting of –C(O)OH or –C(O)OR^1, R^{2}O C(O)– wherein R^1 and R^2 is C_1-C_{40}-alkyl.

3. A seed treatment formulation according to claim 1 or 2, wherein at least one monomer of the carboxyl group containing polymer or copolymer is selected from the group consisting of (alkyl)acrylic acid and (alky) acrylic acid ester derivates, (meth)acrylamides, cyano(alky)acrylates, acrylonitriles, unsaturated monocarboxylates , hydroxy alkyl esters of unsaturated carboxylic acids, unsaturated (mono) carboxylic acids, vinyl esters and unsaturated polycarboxylic acids and their anhydrides, their mono- or di-esters,

4. A seed treatment formulation according to any of claims 1 to 3, wherein

a) at least one co-monomer of the carboxyl group containing copolymer is a carboxyl group containing co-monomer as defined in claim 3;

b) and at least one other co-monomer of the carboxyl group containing copolymer is a co-monomer selected from the group consisting of C_2-C_6-alkenyl, halogenated alkenyl, C_4-C_{12}-alkenyl, C_4-C_{12}-haloalkenyl, styrene and styrene derivatives, amino group containing aromatic vinyl compounds, epoxy group containing unsaturated compounds, methyl prollidone, triallyl cyanurate, triallyl isocyanurate, diallyl phthalate, allyl sulfonate, vinyl-derivaties, sodium isoprene sulfonate, dicyclopentadienyl, ethylidene norbornene, divinylbenezene, unsaturated alcohols; and

c) and wherein the distribution of monomers is either alternate, statistical or block by block.

5. A seed treatment formulation according to any of claims 1 to 4, wherein the carboxyl group containing polymer or copolymer has a glass transition temperature within the range of –40°C to 15°C.

6. A seed treatment formulation according to claims 1 to 5, wherein the copolymer is selected from the group consisting of acrylate copolymers and ethylene vinyl acetate copolymers.

7. A seed treatment formulation according to any of claims 1 to 6, wherein the amount of polymer or copolymer or wax is between 0,5 and 15 % (w/w).

8. Use of a carboxyl group containing polymer or copolymer or wax, wherein the carboxyl groups are selected from the group consisting of ~C(O)OH or ~C(O)OR^1, R^{2}O C(O)~ wherein R^1 and R^2 is C_1-C_{40} Alkyl for the preparation of a seed treatment formulation.

9. Seeds treated with a formulation according to any of claims 1 to 7.

10. Rice seeds treated with a formulation according to any of claims 1 to 7.

11. A method for the treatment of a seeds prior sowing comprising the following steps:

a) applying to a solvent a formulation according to any of claims 1 to 7; and

b) applying to a seed the mixture obtained in step a).

12. A method according to claim 11 for the treatment of a seeds prior sowing, wherein the seeds are rice seeds.

13. Use of seeds according to claim 9 or 10 in a seed priming process.

14. A method for combating insects and/or fungi comprising applying a formulation according to any of claims 1 to 7 to seeds prior sowing.

15. A method for combating insects and/or fungi comprising applying a formulation according to any of claims 1 to 7 to rice seeds prior sowing.

Formulation for seed treatment

Abstract

A seed treatment formulation comprising

(a) at least one pesticidal agent; and

(b) a carboxyl group containing polymer or copolymer or wax, wherein the carboxyl groups are selected from the group consisting of $-C(O)OH$ or $-C(O)OR^1$, $R^2O\ C(O)-$ wherein R^1 and R^2 is C_1-C_{40}-alkyl;

seeds containing it, a method for treatment of seeds prior sowing, a method for combating insects and/or fungi.